

PROLACTIN-ADRENAL INTERACTIONS IN THE IMMATURE FEMALE RAT

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Both the adrenal glands and prolactin have been shown to participate in the timing of the onset of puberty in female rats. GORSKI and LAWTON (1972) reported that adrenalectomy up to day 25 significantly delayed vaginal opening and CLEMENS *et al.* (1969) demonstrated that either injections or median eminence implants of prolactin significantly enhanced vaginal opening. In the adult rat, an adrenal-prolactin interaction has been demonstrated, that is, prolactin has been shown to enhance progesterone (PIVA *et al.*, 1973) and corticosterone (LIS, GILARDEAU and CHRETIEN, 1973) secretion from the adrenals. In light of the aforementioned work, it was thought of interest to study the possible relationship between prolactin and the adrenal glands in the immature female rat. Sprague-Dawley rats were used in all experiments. Prolactin binding studies were performed using methods previously described (GELATO *et al.*, 1975). Prolactin binding activity was measured in adrenal microsomal membranes of female rats at 23, 28, 33, 38, 43 and 75 days of age. In a second series of experiments animals were adrenalectomized at 20 days of age and beginning on day 21 groups of intact and adrenalectomized rats were treated with either prolactin (0.35 mg/rat twice daily) or progesterone (2 µg/rat/day) until the day of vaginal opening or progesterone (2 µg/rat/day) until 26 days of age. Another group of rats adrenalectomized and adrenalectomized treated with prolactin were decapitated at 25, 29 and 33 days of age and at vaginal opening. Sera from these rats were assayed for prolactin using standard radioimmunoassay techniques. A final group of rats were treated with progesterone (2 µg/rat/day) starting at 8 days of age and continuing until 25 days of age. Vaginal opening was checked in these animals.

Adrenal membrane preparations from immature rats specifically bound a significant amount of radio-labelled prolactin. In adrenal membrane fractions (containing

100 µg protein) from 23 and 28 day old rats 85 p. 100 of the total radioactivity bound (10,000 c.p.m.) was able to be displaced by excess unlabelled hormone whereas only 20 p. 100 of the radioactivity bound was able to be displaced from membranes of 75 day old rats.

Adrenalectomy significantly ($P < 0.01$) delayed vaginal opening, 43.6 ± 0.9 day as compared to intact and sham control rats, 39.7 ± 0.5 days. Prolactin treatment in intact rats advanced puberty by more than one week (30.5 ± 0.4 days) and in adrenalectomized rats returned vaginal opening to that of intact controls (40 ± 0.9 days vs. 39.7 ± 0.5 days).

The following table shows the serum prolactin levels (ng/ml NIAMDD RP-1) in these rats, decapitated between 17.00 and 18.00 h on the days indicated.

TABLE I

Serum prolactin levels in intact and adrenalectomized rats, with or without prolactine treatment

	Days of Age			at Vaginal Opening
	25	29	33	
Intact Controls (9)	94 ± 16	218 ± 27	350 ± 67	307 ± 49
Adrenalectomized (7)	30 ± 3	74 ± 13	71 ± 18	145 ± 28
Intact + Prolactin (9)	52 ± 12	111 ± 5	50 ± 8	227 ± 54
Adrenalect. + Prolactin ± SEM (7)	26 ± 3	27 ± 5	42 ± 6	130 ± 18

In all treatment groups serum prolactin levels were significantly depressed ($P < 0.01$) except at vaginal opening in intact prolactin treated rats. Progesterone treatment in either adrenalectomized rats (48 ± 0.9 days) or in intact (42 ± 0.6 days) rats significantly delayed vaginal opening when compared to adrenalectomized control (44 ± 0.7 days) or intact control rats (37.5 ± 0.6 days). These data show that 1) immature rat adrenal membrane preparations bind significantly more radio-labelled prolactin than adrenals from adult rats, 2) adrenalectomy and progesterone treatment are both able to delay the onset of puberty, 3) prolactin is able to overcome the effects of adrenalectomy but yet does not enhance vaginal opening as it does in intact rats and 4) the effects of adrenalectomy may be due in part to an alteration of endogenous prolactin levels. Thus the data indicate that prolactin and the adrenals interact in normal sexual development in female rats and that prolactin is possibly a key hormone in the timing of the onset of puberty.

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RÉSUMÉ

INTERACTIONS SURRÉNALES-PROLACTINE CHEZ LA RATTE IMMATURE

Les préparations de membranes de surrénales de Ratte immature lient spécifiquement quatre fois plus de prolactine ovine marquée que celles de Ratte adulte. La surrénalectomie retarde significativement l'ouverture vaginale et déprime le niveau de prolactine sérique. On peut, par des injections de prolactine, ramener l'ouverture vaginale à l'âge observé chez les témoins. Un traitement à la progestérone retarde significativement l'ouverture vaginale chez les Rattes entières et provoque un retard supplémentaire chez les Rattes surrénalectomisées. La prolactine semble donc jouer un rôle plus important dans la fonction surrénalienne chez la Ratte immature que chez la Ratte adulte. Les effets de la surrénalectomie doivent être dus en partie à une déficience en prolactine. La prolactine et les surrénales interagissent dans le développement sexuel de la Ratte et la progestérone doit jouer un rôle dans cette interaction.

REFERENCES

- CLEMENS J. A., MINAGUCHI H., STORY R., VOOGT J. L., MEITES J., 1969. Induction of precocious puberty in female rats by prolactin. *Neuroendocrinology*, **4**, 150-156.
- GELATO M., MARSHALL S., BOUDREAU M., BRUNI J., CAMPBELL G. A., MEITES J., 1975. Effects of thyroid and ovaries on prolactin binding activity in rat liver. *Endocrinology*, **96**, 1292-1296.
- GORSKI M., LAWTON I. E., 1972. Timing of prepuberal adrenal-ovarian interaction in the rat. *Fifth Annual Meeting, Society for the Study of Reproduction* (Abstract).
- LIS M., GILARDEAU C., CHRÉTIEN M., 1973. Effect of prolactin on corticosterone production by rat adrenals. *Clin. Res.*, **21**, 1027.
- PIVA F., GAGLIANO P., MOTTA M., MARTINI L., 1973. Adrenal progesterone : factors controlling its secretion. *Endocrinology*, **93**, 1178-1184.
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